

USSN 09/781,793
Amendment Responsive to Office Action of December 16, 2003
April 16, 2004
A-1714

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A knotless suture anchor apparatus for anchoring a length of suture with respect to a body cavity, comprising:

an anchor body having an anchoring structure for fixing the anchor body within a body cavity, the anchor body having a proximal end, a distal end, and a lumen opening at the proximal end, the anchor body further including a suture pulley axially fixed with respect to the anchor body such that a length of suture may be introduced into the lumen from the proximal end, looped around the pulley, and passed out of the lumen through the proximal end; and

a suture locking plug movable within the lumen from a first position to a second position; and

an actuator other than said length of suture for moving said suture locking plug from said first position to said second position.

2. (Original) The apparatus of claim 1, wherein the suture locking plug and lumen cooperate such that the suture locking plug does not interfere with axial movement of the length of suture in the first position and interferes with axial movement of the length of suture in the second position.

3. (Original) The apparatus of claim 2, wherein the suture locking plug interferes with axial movement of the length of suture in the second position by compressing the length of suture against the anchor body.

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4. (Original) The apparatus of claim 1, wherein the anchor body is generally tubular and the lumen opens at the distal end as well as at the proximal end.

5. (Original) The apparatus of claim 4, wherein the distal end of the anchor body is discontinuous at one side thereof, and a slot extends in a proximal direction from the discontinuity to a slot end, and wherein the suture locking plug comprises a proximal section that fits within the lumen and a distal stop extending radially outward into the slot that interferes with the anchor body at the end of the slot and limits proximal movement of the plug with respect thereto.

6. (Original) The apparatus of claim 4, wherein the suture locking plug comprises a shaft axially displaceable within the lumen.

7. (Original) The apparatus of claim 6, wherein the suture locking plug further includes a distal stop larger in cross-sectional dimension than the lumen diameter that interferes with the anchor body and limits proximal movement of the shaft with respect thereto.

8. (Currently Amended) The apparatus of claim 7, ~~further including~~ wherein said actuator comprises an actuation rod removably attached to the proximal end of the shaft and projecting out of the proximal end of the anchor body, the actuation rod being usable to displace the shaft axially within the lumen.

9. (Currently Amended) The apparatus of claim 8, and further including a point of tensile weakness along the actuation rod for permitting the rod to be detached from the shaft upon application of a predetermined tensile force on the actuation rod in the proximal direction after the distal stop of the suture locking plug contacts the anchor body.

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10. (Original) The apparatus of claim 1, wherein the fixed suture pulley is formed in a sidewall of the lumen.

11. (Currently Amended) The apparatus of claim 10, wherein the anchor body comprises a tubular body defining the lumen therein which is cylindrical, and the fixed suture pulley is disposed at a distal end of the tubular body.

12. (Original) The apparatus of claim 11, wherein the lumen opens at the distal end of the tubular body as well as at the proximal end, and wherein the pulley comprises a rod at the open distal end transverse to the lumen axis.

13. (Original) The apparatus of claim 12, wherein the rod rotates with respect to the anchor body.

14. (Original) The apparatus of claim 11, wherein the pulley comprises a bridge between two spaced apertures at the distal end of the tubular body.

15. (Currently Amended) A knotless suture anchor apparatus for anchoring a length of suture with respect thereto, comprising:

an anchor body having a proximal end, a distal end, and a lumen opening at the proximal end, the anchor body further including a suture pulley fixed with respect to the anchor body such that a length of suture may be introduced into lumen from the proximal end, looped around the pulley, and passed out of the lumen through the proximal end; and

a suture locking plug movable within the lumen from a first position which does not interfere with axial movement of the length of suture to a second position that compresses the length of suture against the anchor body and interferes with axial movement of the length of suture; and

an actuator other than said length of suture for moving said suture locking plug from said first position to said second position.

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16. (Original) The apparatus of claim 15, wherein the anchor body is generally tubular and the lumen opens at the distal end as well as at the proximal end.

17. (Original) The apparatus of claim 16, wherein the suture locking plug comprises a shaft axially displaceable within the lumen and a distal stop larger in cross-sectional dimension than the lumen diameter that interferes with the anchor body and limits proximal movement of the shaft with respect thereto.

18. (Currently Amended) The apparatus of claim 17, further including wherein said actuator further comprises an actuation rod removably attached to the proximal end of the shaft and projecting out of the proximal end of the anchor body, the actuation rod being usable to displace the shaft axially within the lumen.

19. (Original) The apparatus of claim 15, wherein the fixed suture pulley is formed in a sidewall of the lumen.

20. (Original) The apparatus of claim 19, where the anchor body comprises a tubular body defining the lumen therein which is cylindrical, and the fixed suture pulley is disposed at a distal end of the tubular body.

21. (Original) The apparatus of claim 20, wherein the lumen opens at the distal end of the tubular body as well as at the proximal end, and wherein the pulley comprises a rod at the open distal end transverse to the lumen axis.

22. (Original) The apparatus of claim 21, wherein the rod rotates with respect to the anchor body.

23. (Original) The apparatus of claim 20, wherein the pulley comprises a bridge between two spaced apertures at the distal end of the tubular body.

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24. (Currently Amended) A knotless suture anchor apparatus for anchoring a length of suture with respect to a body cavity, comprising:

an anchor body having an anchoring structure for fixing the anchor body within a body cavity, the anchor body having a proximal end, a distal end, and a lumen opening at both the proximal and distal ends, the lumen having a diameter that permits a length of suture to be passed therethrough; and

a suture locking plug comprising a shaft axially displaceable within the lumen, wherein the suture locking plug is movable within the lumen from a first position which does not interfere with axial movement of the length of suture to a second position that interferes with axial movement of the length of suture, and wherein a stop is provided that positively interferes with proximal movement of the suture locking plug with respect to the anchor body; and

an actuator other than said length of suture for moving said suture locking plug from said first position to said second position.

25. (Currently Amended) The apparatus of claim 24, ~~further including wherein~~ said actuator comprises an actuation rod removably attached to the proximal end of the shaft and projecting out of the proximal end of the anchor body, the actuation rod being usable to displace the shaft axially within the lumen.

26. (Currently Amended) The apparatus of claim 25, and further including a point of tensile weakness along the actuation rod for permitting the rod to be detached from the shaft upon application of a predetermined tensile force on the actuation rod in the proximal direction after the stop engages.

27. (Original) The apparatus of claim 24, wherein the anchor body further includes a suture pulley fixed with respect to the anchor body such that the length of suture may be passed into lumen from the proximal end, looped around the pulley, and passed out of the lumen through the proximal end.

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28. (Original) The apparatus of claim 27, wherein the fixed suture pulley is formed in a sidewall of the lumen.

29. (Original) The apparatus of claim 28, wherein the anchor body comprises a generally tubular body defining the lumen therein, and the fixed suture pulley is defined by a rod disposed transversely around a portion of the body and distal to an opening in the body.

30. (Original) The apparatus of claim 24, wherein the anchor body comprises a generally tubular body defining the lumen therein, and the fixed suture pulley is defined by a bridge between two spaced apertures at the distal end of the body.

31. (Original) The apparatus of claim 24, wherein the suture locking plug interferes with axial movement of the length of suture in the second position by compressing the length of suture against the anchor body.

32. (Currently Amended) A method of securing soft tissue, with respect to a body cavity, without knots, comprising:

- passing a length of suture through soft tissue so that a loop of suture material is embedded in the soft tissue resulting in two free ends;
- providing an anchor body having an open proximal end and a lumen, and a pulley fixed with respect to the anchor body;
- passing the two free ends of the length of suture into the lumen of the anchor body through the open proximal end, looping them around the pulley, and extending the two free ends out of the lumen through the open proximal end;
- fixing the anchor body with respect to a body cavity;
- tightening the loop of suture material by pulling on one or both of the two free ends of the length of suture; and

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fastening the two free ends of the length of suture with respect to the anchor body without knots.

33. (Original) The method of claim 32, wherein the soft tissue is a tendon, and a body cavity is formed in a bone.

34. (Original) The method of claim 33, wherein the tendon is the rotator cuff tendon, and wherein the bone is the humerus.

35. (Original) The method of claim 32, wherein the step of fixing the anchor body with respect to the body cavity comprises forming the body cavity, passing the anchor body into the body cavity, and radially expanding anchoring structure on the anchor body.

36. (Original) The method of claim 35, wherein the body cavity is a cylindrical tunnel formed in a bone, and wherein the anchoring structure is provided on a proximal end of the anchor body so as to interfere with the cortical layer of the bone and prevent proximal removal of the anchor body from the cylindrical tunnel.

37. (Currently Amended) The method of claim 32, said method further including providing a suture locking plug movable within the lumen from a first position which does not interfere with axial movement of the two free ends of the length of suture to a second position that compresses the two free ends of the length of suture against the lumen and interferes with axial movement thereof, the step of fastening including displacing the suture locking plug from the first position to the second position.

38. (Currently Amended) The method of claim 37, and further including providing an actuator for moving said suture locking plug ~~a proximal actuation rod coupled to the suture locking plug that extends out of the lumen from the proximal end~~

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~~of the anchor body, the step of displacing the suture locking plug comprising displacing the actuation rod in a proximal direction with respect to the anchor body.~~

39. (Currently Amended) The method of claim 38, wherein said actuator comprises a proximal actuation rod coupled to the suture locking plug that extends of out of the lumen from the proximal end of the anchor body, the step of displacing the suture locking plug comprising displacing the actuation rod in a proximal direction with respect to the anchor body further including the step of severing the actuation rod from the suture locking plug after the step of fastening.

40. (New) The method of claim 39, and further including the step of severing the actuation rod from the suture locking plug after the step of fastening.

41. (New) A device for anchoring a suture to tissue or bone, comprising:
a first component adapted to be embedded in bone and having at least one passage therein;
a suture having at least a portion extending from the at least one passage; and
a second component receivable within the first component such that the first and second components are effective to retain the suture therebetween by compression.

42. (New) A knotless suture anchor apparatus for anchoring a length of suture with respect to a body cavity, comprising:
an anchor body having an anchoring structure for fixing the anchor body within a body cavity, the anchor body having a proximal end, a distal end, and a lumen opening at the proximal end, the anchor body further including a suture pulley axially fixed with respect to the anchor body such that a length of suture may be introduced into the lumen from the proximal end, looped around the pulley, and passed out of the lumen through the proximal end; and

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a suture locking plug movable within the lumen from a first position to a second position, wherein said first position is located distally of said suture pulley and said second position is located proximally of said suture pulley.